Alva Burkhalter Updates

The White Amur Controversy

RESEARCHERS are making a concerted effort to find biological control organisms for noxious aquatic plants. The three primary control groups being studied are insects, diseases, and fish. Perhaps the most controversial group of biological control agents is the fish, of which the white amur has received the most criticism.

The white amur is a member of the family Cyprinidae — the minnow or carp family — and is indigenous to the great rivers forming the boundary between northern China and southern Russia. Once it grows to three or more centimeters, the amur is almost exclusively a herbivore and offers promise for controlling aquatic higher plants. Investigated as a potential biological control agent for submerged aquatic weeds, the fish has an outstanding history.

The amur was first introduced in the U.S. in 1963 at the Bureau of Sport Fishery and Wildlife's Fish Farmer Experiment Station at Stuttgart, Ark. Research was initiated at the station and at Auburn University in Alabama. In the late 1960's, the Arkansas Game and Fish Commission started using the white amur in an operational aquatic weed control program. This action initiated the controversy that exists today. There was an immediate uproar from the other states who banned the amur from introduction until more was known about its environmental impact in the U.S. The white amur is now being studied intensively in a number of these states, many of which feel it has a tremendous future in aquatic plant control.

In preparing this manuscript, my initial step was to phone other state representatives actively involved in white amur research. I asked two general questions: What were their past and present programs with the fish? What future investigations were planned? I will take each state contacted and briefly summarize the responses.

ARKANSAS — Since much of the controversy started with the Arkansas Game and Fish Commission's endorsement of the white amur, I feel it would be appropriate to start with the State of Arkansas. Bill Bailey, fisheries biologist with the Commission, has been engaged in work with the white amur since shortly after its arrival. He studied the fish in closed systems until the late 1960's, then Arkansas began releasing amur into public waters. The fish has since become the primary means of aquatic plant control. In addition, Arkansas also has investigated artificial propagation of the amur, its effect on selected native sport fish and its commercial and sporting potential.

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Virtually all public lakes with submerged weed problems in Arkansas have been stocked with this biocontrol agent. This has involved more than 100 public lakes, totaling more than 50,000 surface acres and 380,000 white amur. The exact number of private ponds and lakes that have been stocked is unknown.

The initial controversy arose from the fact that many of the stocked lakes are in the Mississippi River watershed which comprises a drainage area equivalent to almost three-quarters of the U.S.The white amur currently is distributed from the lower Mississippi in Louisiana to the Missouri River into Nebraska, including the Ohio, Tennessee, and numerous other rivers connecting with Mississippi drainage. This strongly suggests presence of the amur in the waters of three-quarters of the U.S.

To date, no one has confirmed natural reproduction. All fish captured thus far can be traced to known age groups accidentally escaped from Arkansas. Most captured fish have weighed several pounds and no fingerlings or fry have been recorded. One paradox of this situation is that many states are still arguing over releasing this fish into their waters. Since the amur now has access to the vast area between the Appalachian and Rocky Mountains via the Mississippi River, it seems this argument makes as much sense as "hip boots on a boar hog." For at least three-quarters of the U.S., this argument is ludicrous.

I asked Bailey if the Arkansas Game and Fish Commission felt it had made the correct decision in releasing the white amur. I received an unequivocal "YES" to that question. They have attained good weed control, recorded no adverse effects on sport fisheries and feel they will continue to have one of the finest waterfowl-hunting states in the country. Even though fish have escaped into the Mississippi River, Arkansas feels that there is no imminent danger. If the amur reproduces naturally in the Mississippi watershed, Arkansas feels it will be controlled by its own demand of a highly selective spawning site or by natural predation.

Bailey made an interesting statement in one of his reports: "The stocking of white amur in weed control concentrations has produced definite long-range, detrimental effects on one species — the white amur itself." In other words, white amur used at proper rates appear only to be detrimental to themselves since they tend to lose weight even to the point of starvation when

the submerged weeds are eliminated.

There are several large commercial fish farms in Arkansas currently producing and selling white amur for weed control. The fish farmers are advertising in magazines such as *Progressive Farmer, The Commercial Fish Farmer,* and many others. Their advertisements get wide distribution as do their commercial sales. There is no federal legislation that prohibits these dealers from selling fish to persons in any other state — only legislation within the various states it may enter. Therefore, the only way a state can stop the entry of the fish is to confiscate it upon entry.

Many of the small cyprinid minnows commonly sold as bait closely resemble the white amur. Unless examined by a well-trained person, the amurs would likely pass as just another shipment of bait minnows. Therefore, legally or illegally, the fish is already in nearly every state — particularly those which encourage farm pond practices.

Be it blessing or curse, Arkansas' stocking and sale of the white amur has forced many states to backtrack and initiate research programs. Regardless of their position on the fish, most states now have it in their natural waters.

ALABAMA — Since Auburn University obtained amur concurrently with Arkansas, they probably have conducted as much scientific investigation as anyone, particularly towards farm pond use. Many fishery scientists at Auburn have been working on white amur studies for eight years. They have studied its artificial propagation, dietary preference, feeding habits, effects on water quality and effects on native sport fishes.

Most of Auburn's fisheries personnel feel there is tremendous potential for the use of white amur as a control tool in farm ponds. They have found the amur, if properly used, will provide good aquatic plant control with no adverse effect on the sport fisheries.

Probably the most damaging scientific evidence against the use of the amur was reported by Dr. John Lawrence, fisheries scientist at Auburn. When stocked at excessive rates in fertilized ponds void of vegetation or lightly vegetated, amur may interfere with bluegill recruitment. Lawrence feels that this does not damage the potential use of the fish in farm ponds, but rather the fish should not be used at random stocking rates.

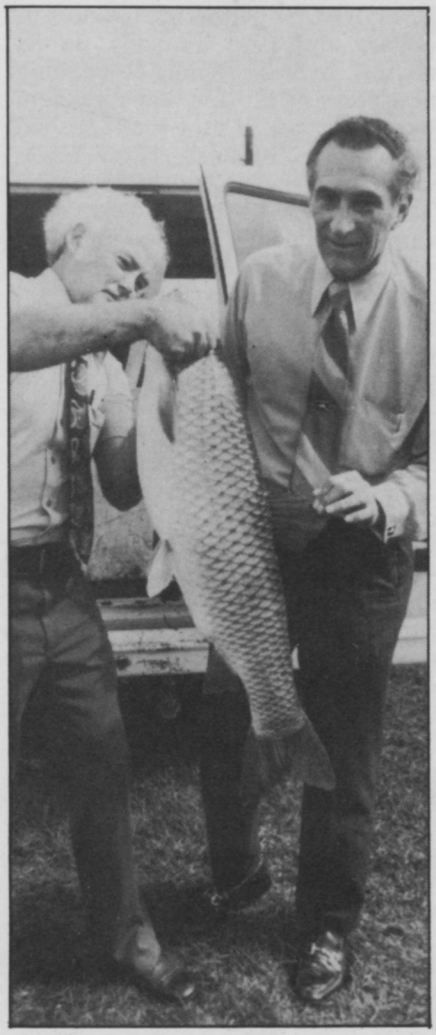
A very precarious situation exists in Alabama. Although Alabama's Game and Fish Commission officially has taken no action for or against the fish, it nevertheless is being sold commercially within the state and probably is being used in farm ponds as extensively as in Arkansas. In fact, the fish is being sold in many bait shops and some commercial dealers even advertise in farm and ranch magazines.

FLORIDA — Since Florida has the most severe aquatic plant problem in the U.S., much of the present day controversy over the white amur is centered around this state.

White amur were brought into Florida in the late 1960's. Initial studies with the amur started as a joint effort between the University of Florida and the U.S. Department of Agriculture Laboratory under the direction of Dr. David Sutton and Robert Blackburn. Early work evaluated plant preferences and changes in water quality in aquaria and small plastic pools. Under a permit from the Game and Fresh Water Fish Commission and funding by the Florida Department of Natural Resources, Sutton initiated further studies in 1970.

Currently, the white amur is stocked in approximately 10 to 12 locations in the state. All are closed systems ranging from 5 to 250 acres. Plans are being promulgated to stock additional lakes, some of which will exceed 1,000 acres.

To date, most of the research conducted in Florida supports the ability of the amur as a weed control agent. No past studies have confirmed any undesirable effects on sport fish, water quality or other parameters of the aquatic environment. The crux of the controversy in Florida is not whether the fish does or does not have potential as a weed control agent — the controversy centers around the possibility of the fish naturally reproducing in the river systems of the state in sufficient quantities to pose a threat to fisheries and waterfowl populations. Proponents of the white amur, such as myself and my staff, feel there is little scientific evidence to warrant this extreme fear and caution. Opponents of the fish, primarily the Florida Game and Fresh Water Fish Commission and several environmental groups, feel that all programs should proceed with extreme caution until more information is obtained on the potential reproduction of the fish in Florida's rivers. If the fish is ever given a clean bill of health, Florida, more than any other state in the Union, stands to benefit from its use.



The Honorable William E. Fulford (right), Florida House of Representatives, Orlando District No. 40, examines a white amur. Florida, with the most severe aquatic plant problem in the United States, has the most to gain with the use of the amur as aquatic weed controllers.

Florida has a severe submerged weed problem, particularly with a species of plant commonly called Florida elodea or hydrilla *(Hydrilla verticillata).*

Introduced from the Malaysia-Indonesia area in 1959, it has spread rapidly and now infests over 100,000

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acres of water. Although millions of dollars are spent annually on its control, hydrilla rapidly is invading new areas of Florida and spreading to other states. It now is established in Georgia, Louisiana, Texas, Iowa, Oklahoma and several other states.

Currently, hydrilla is being controlled chemically at an average cost of 150 to 300 dollars per acre. Studies show that this soft-bodied plant can be controlled easily and economically by the white amur; preliminary costs range from 15 to 25 dollars per acre and would constitute a persistent treatment.

Regardless of the controversy, amur are still being moved and sold commercially to people in the state. The Florida Game and Fresh Water Fish Commission at last count documented approximately 32 cases of illegal stocking of white amur. I seriously doubt if this represents even one-tenth of the actual illegal stockings.

Hopefully, answers to many questions will be forthcoming in future years. Studies currently are underway in Florida to determine impact of the amur on sport fish, water quality, benthic organisms, vegetation and other parameters.

LOUISIANA — To update Louisiana's position and work with the white amur, I called Louie Richardson, supervisor of aquatic plant control research for the Louisiana Wildlife and Fisheries Commission.

Louisiana initially took a "hands off" position on the white amur after the initial release by Arkansas. Later, Dr. Dana Sanders at Northwestern Louisiana State University, under permit from the Louisiana Wildlife and Fisheries Commission, began studies on the white amur/common carp hybrid. For all practical purposes, a hybrid would be sterile. If it retained parental characteristics of the white amur, the hybrid could be used without fear of reproduction. The presence of white amur in the natural waters of Louisiana and loss of some desirable parental amur characteristics has prompted Louisiana to discontinue hybrid investigations and concentrate efforts exclusively on the amur.

Some white amur escapes from Arkansas were first recorded in the Louisiana portion of the Mississippi River. Louisiana has confirmed the commercial and sporting catches from the Mississippi and its tributaries of more than 50 white amur ranging from nine to 40 pounds. Although there have been 50 confirmed captures, Richardson suspects this represents only a small portion of what has actually been taken. He additionally informed me that a commercial market is beginning to establish in Louisiana, and the amur is referred to as the shiner buffalo. In fact, local people ask for the shiner buffalo by name at market places.

An environmental impact study is being conducted by university fishery scientists within Louisiana and the Louisiana Wildlife and Fisheries Commission biologists. During the current year, six 30- to 250-acre lakes are to be stocked. Research considerations include the effect of the white amur on aquatic vegetation, water, quality, sport fisheries, benthic organisms and other parameters of the aquatic ecosystem. They also are examining the effects of the white amur on crawfish since the state supports a large crawfish industry.

In summary, Louisiana's policy on white amur research is one of "proceed with caution," but they do feel the fish has potential for use as a biological control tool.

GEORGIA — Georgia began investigations with the white amur several years ago. Dr. Al Fox, Cooperative Fishery Unit, University of Georgia, has investigated the weed control potential of the white amur together with the impact of the white amur on sport fish, water quality, algae production, and benthic organisms. Basically, his results have been encouraging. The amur has exhibited good weed control and has not exhibited detrimental effects on sport fish, even at high stocking rates with sparse vegetation.

I talked with Leon Kirkland, chief of the Fisheries Division, Georgia Department of Natural Resources, who informed me that they currently are conducting a single study on the white amur. Kim Primer, fisheries biologist in Calhoun, Georgia, is investigating the amur in hatchery pond management for control of *Pithophora*, a species of filamentous algae. Primer reported very good *Pithophora* control which enhanced sport fish, primarily striped bass and catfish, recovery. He also noted that the amur can be aggravating to fish recovery because they are very active (particularly when seined) and thrash violently in the net occasionally causing harm to the recovery species. However, Primer felt the better recovery obtained as a result of the weed control made up for this small inconvenience.

Primer said 123 five-pound amur were stocked in a 16-acre *Pithophora*-infested catfish pond open to public fishing. Within a year, the amur had grown from five to 14 pounds, the *Pithophora* was controlled and two white amur were caught by fishermen. He reported that no additional research was planned except for minor investigations in some southern hatcheries.

IOWA — A newcomer into white amur research is the State of Iowa. The person currently conducting investigations is Larry Mitzner, fisheries biologist with the Iowa Conservation Commission. In 1973, the Commission stocked Red Hall Lake, a 73-acre impoundment in southern Iowa, and plan to evaluate the effectiveness of the amur in controlling undesirable aquatic vegetation and its effect on sport fish population. To date, Mitzner has been pleased with the degree of vegetation control obtained and the absence of significant water quality changes. I would evaluate Iowa's attitude as optimistic, but again with a cautious approach towards research.

ILLINOIS — Dr. Bill Lewis, University of Southern Illinois, has been using the amur for weed control for several years in many of the hatchery ponds at the fisheries research center where catfish, bluegill, bass and several other species are reared. Lewis is highly satisfied with the weed control ability of the amur, its palatability, and its compatability with catfish and centrarchids. Additionally, he said white amur have been recovered from the Illinois reaches of the Mississippi River.

NORTH DAKOTA — I had a very interesting conversation with Dale Henager of the North Dakota Game and Fish Commission. In August, 1973, 5,000 three-inch fingerlings were stocked in a 500-acre closed-basin lake which has an excellent population of northern pike. Gut analysis of pike taken from the lake after stocking revealed that many small amur were being consumed by the pike. However, no amur have been recovered in rotenone or pike gut samples taken after the first overwintering which suggests few if any residual amur. According to Henager, northern pike probably are highly predaceous on small white amur and the amur may not be able to tolerate North Dakota winters.

Although the white amur does tolerate winter conditions equivalent to North Dakota in its native range, it does so primarily in large river systems. The North Dakota lake was a non-flowing type and probably has much colder winter temperatures than the Amur River. Henger said the final demise of the amur was probably the severe North Dakota winters, but pike predation also played a significant role.

Additionally, he said that 800 to 900 fry were stocked in a small spring-fed pond. Although this pond contained very few predator species, there were no amur recaptured after one winter. Therefore, no further research is planned in North Dakota since the winters probably

(continued on page 35)

WHITE AMUR *(from page 29)*

are too severe for white amur survival.

PUERTO RICO — Bill Rushing, Corps of Engineers, Waterways Experiment Station, Vicksburg, Miss., informed me that the Corps and the Commonwealth of Puerto Rico are planning white amur research in Puerto Rico. Amur were stocked primarily for weed control evaluations in small ponds ranging from one to 15 acres on the Del Rado Beach property. The Commonwealth is planning to stock several large freshwater reservoirs which supply water to major cities and are plagued by submerged weeds.

TENNESSEE — Tennessee recently initiated investigation of the white amur in small ponds at the Oak Ridge Laboratory under the direction of Dr. Larry Wilson. Wilson will investigate plant preference and effectiveness of the white amur as a weed control agent and he will evaluate the impact of the white amur on native farm pond fishes and the sporting potential of the white amur.

Bill Campbell, Tennessee Game and Fish Commission, said white amur have been taken from Real Foot Lake and are probably from Arkansas stockings. Real Foot is in the northwestern part of the state and connects via canal to the Mississippi River. He feels the amur definitely is now in the Tennessee River watershed.

Leon Bates, biologist with the Tennessee Valley Authority (TVA), said the TVA stocked a small farm pond in Alabama to evaluate the aquatic weed control potential of the white amur. The pond was approximately an acre and was stocked with five three-pound amur. The fish did an excellent job in controlling weeds, and grew to approximately 26 pounds in two and one-half years. The amur did such an effective job that the farmer was very hesitant to allow TVA to recover the fish and insisted that the recovered fish be replaced.

Bates also said several Alabama ponds which occur along the Tennessee River are stocked with the white amur. Since these ponds were flooded by the Tennessee River this year, white amur now must be widespread in the Tennessee River watershed.

MISSOURI — Dr. Jim Whitley, Missouri Conservation, Division of the Game and Fish Department, is very concerned about white amur movement from Arkansas to Missouri. Since Missouri borders Arkansas, he feels the introduction of white amur in Arkansas leaves Missouri little choice concerning the amur. This has resulted in a heated contention between states over the potential use of the white amur. Whitley is concerned that the white amur may meander into some of the Ozark streams which contain native aquatic plants upon which he feels the associated fish production is dependent.

Whitley has investigated the feeding habits of small amur to determine if and under what conditions white amur will feed on organisms other than plants. He has reported that small amur will feed on *Gammarus* spp,. a small crustacean commonly known as scud, and that one-tenth pound white amur consumed fry of bluegills and guppies in aquaria void of vegetation.

Dr. William Pfliger, an associate of Whitley's, is working with commercial fishermen to establish the distribution of the white amur in the U.S., especially in the Mississippi watershed. He is also trying to determine if the amur has reproduced naturally in the Mississippi drainage.

According to Whitley, several nine- to 15-pound amur have been taken in the Missouri River. Whitley said Dr. Richard Anderson, Cooperative Fishery Unit, is conducting water quality and algae production studies on the white amur in aquaria.

CALIFORNIA — Dr. Pete Frank, U.S. Department of Agriculture at the University of California, is project leader on the white amur work, the main thrust of which is to produce a sterile amur. Instead of going the route of hybrid production, various chemical means of inducing sterility are being investigated. White amur are also being evaluated for weed-control potential and effects on sport fish, particularly bluegill. These studies are being conducted in small one-tenth acre ponds.

The California Game and Fish Commission has banned importation of the amur and is not receptive to research except under highly controlled conditions. Frank feels the Commission will not allow expanded white amur studies in natural situations until sterile fish are produced.

SUMMARY — Although virtually all states have banned importation of the white amur, many states are beginning to actively investigate its potential as a biological control agent for aquatic weeds. This is particularly true of the southeastern states which experience the most severe aquatic weed problems. Above the roar of the controversy, the true facts of the white amur are beginning to surface. I feel more encouraged with each additional bit of gathered information in hopes that we soon may be able to determine the final fate of this fish and its proper place in weed control. Each state, however, seems determined to conduct its own studies on the basic considerations, namely impact and feeding.

With better cooperation and communication within and among the states, we could resolve the mysteries and myths of the notorious white amur and get to the real crux of the matter — the truth. There is nothing so tragic as one with eyes and ears who does not hear or see. □